



Comparing Reasons, Practices and Effects of ISO 9000 Certification and TQM Implementation in Norwegian SMEs and Large Firms

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This article records the empirical research that investigates the reasons behind, practices and effects of ISO 9000 certification and Total Quality Management (TQM) implementation in small and medium-sized (SME) and large manufacturing companies. The research is based on a survey of 180 Norwegian manufacturing companies. The main findings are (1) the SMEs implement ISO 9000 standards and TQM mainly because of market and customer demand or external pressure rather than internal initiation; (2) in practicing TQM, the SMEs focus on informal, people-oriented approaches; large firms are relatively more structured, organized and process-oriented; (3) different facets of TQM contribute differently in SMEs and large firms; (4) no significant relation exists between the current ISO 9000 certification and TQM practices/improvement of business performance. The conclusion is that there are some significant differences between SMEs and large firms in implanting ISO 9000 certification and TQM. These differences trigger discussions on practical implications for managers in SMEs and large firms. Finally, the limitations of the research and implications for future research are explored.

KEYWORDS: comparative study; ISO 9000 certification; TQM; SME

Introduction

The contribution of small and medium-sized enterprises (SMEs) has been recognized worldwide. For example, in the UK, about two-thirds of the workforce is in this sector and virtually all large companies depend on SMEs for their suppliers and subcontractors (Parkin and Parkin, 1996). These small businesses generate over a third of UK business turnover (North et al., 1998). In the USA, small firms employ 65% of all US manufacturing workers. As large manufacturers increase their dependence on suppliers for parts and services, the performance and capabilities of small manufacturers become even more critical to the entire manufacturing sector and to the health of the US economy. The year 1999 was declared the Year of Small Manufacturers in the USA. In Finland,

SMEs are a crucial part of the Finnish economy. Firms with less than 200 employees make up 98% of Finnish industrial enterprises, and employ about 34% of the industrial workforce (Gunasekaran et al., 1996). On average, SMEs in Organization for Economic Co-operation and Development (OECD) countries make up about 63% of the manufacturing industry and employ from 45% of the labour force in Australia to 79% in Switzerland. Their contributions to GDP vary from 23% in Australia to 66% in Portugal (OECD, 1997). Indeed, trends indicate that the percentage of employees in SMEs will increase.

According to a survey of SMEs, 82% of responder companies regarded the quality of their product or service as a very important measure of business success (Barrow, 1998). The experiences of large companies using TQM have demonstrated its effectiveness in improving quality, customer satisfaction, and competitiveness (Price and Chen, 1993). Following the introduction of TQM from Japan to the West, large companies have followed each other in implementing TQM and these changes have been extensively documented (Filippini, 1997). Researchers recommended that small firms could successfully implement TQM programmes and reap the benefits in the marketplace (Longenecker et al., 1997). However, research reveals that most SMEs still shun TQM and other quality programmes such as ISO 9000 standards (Gunasekaran et al., 1996; Spendlove, 1997). In the USA, for example, the quality movement has been limited to large corporations, while small firms seemed to be unaffected by the movement (Haksever, 1996). This is more or less the same in the UK (North et al., 1998). Although growing, research on TQM and ISO 9000 in SMEs is still lagging behind that on TQM in large companies. Research comparing quality management in small and large firms is even scarcer.

This article records research that empirically compares quality management between small and large manufacturing companies that have implemented TQM. The aim of the research is to reveal the differences/similarities between SMEs and large firms in implementing quality practices including TQM and ISO 9000 certification. The research will have useful practical implications for quality associations and companies. The findings will also help those SMEs that have not embraced TQM start the journey towards its implementation.

This article is structured as follows. After the introduction, the second section will introduce a theoretical framework and relevant hypotheses will be proposed. In the third section, the research method and empirical data will be described. In the fourth section, the results of the differences in quality management practices between SMEs and large companies will be presented and discussed. In the last section, our conclusions on contributions, limitations, and future research will be presented.

Theoretical Framework and Hypotheses

An aggressive effort by a company to achieve superior quality is often termed TQM (Longenecker et al., 1997). TQM implies an all-encompassing, quality-focused management approach to providing products and services that satisfy customer requirements. Despite TQM being included in mainstream quality

management methods, its definition varies from researcher to researcher. Quality award models (American Society for Quality, 1998; Australian Quality Council, 1996; European Foundation for Quality Management (EFQM), 1998) provide a general model for TQM. These models have quickly become prestigious and have resulted in considerable benchmarking among both large and small firms (Dale et al., 1997; Schmenner, 1995). They reflect the best interpretations of what quality is and how it can be achieved, and, for many, they define what TQM really means. Quality awards models have not only operationalized quality but also provided a research framework (Evans, 1997). Previous research (Pannirselvam et al., 1998) demonstrated that the logic of the US Malcolm Baldrige National Quality Award Model (MBNQA) (American Society for Quality, 1998; Hart and Bogan, 1992) is consistent with the principles of quality management proposed by quality gurus (Crosby, 1979; Deming, 1986; Feigenbaum, 1991; Garvin, 1987; Ishikawa, 1985; Juran, 1989). Many research results also support the content and construct validity of the model (Flynn and Saladin, 2001; Flynn et al., 1994; Meyer and Collier, 2001; Pannirselvam et al., 1998; Saraph et al., 1989).

The US MBNQA model establishes three business categories: manufacturing, service and small business. However, the model/guidelines are the same for large firms and SMEs (Schmenner, 1995; Dale et al., 1997; Yusof, 1999). Therefore, in this research, the US MBNQA model is used as a research framework.

In addition to TQM, ISO 9000 standard/certification is another stream of quality management. It refers to a series of standards for quality management systems. Its core module, ISO 9001, provides quality systems for design, development, production, installation and services. It is a comprehensive model of quality systems. A global survey (Ho, 1997) in 80 countries reveals the number of ISO 9000 certificates in 1996 (160,000 firms) was more than double the number in 1994 (70,517 firms). However, ISO 9000 registration seems to be controversial. On the one hand, it is argued that the quality management system based on ISO 9000 standards is a necessary foundation for other quality methods under TQM (Taylor, 1995; Mo and Chan, 1997). A recent survey found that ISO 9000 certificates (standards) help companies gain benefits in internationalization, quality improvement, sales enhancement, and cost reduction (Huang, 1999). On the other hand, other researchers strongly criticize ISO 9000 (Reedy, 1994; Stratton, 1994). Van der Wiele and Brown (1997) found that most SMEs (65% \leq 50 employees, 55% 50–100 employees) seemingly feel forced to apply for ISO 9000 series certification and do not move further down the quality path. This means very few SMEs will be converted into quality believers and will move forward on the TQM journey. Most SMEs feel they have done their bit when they hang the certificate on the wall. A study by the Manchester Business School found that ISO 9000 registration is a worthwhile exercise, but it is not clear how many of those who are awarded it are small firms (Hewitt, 1997). Other researchers also query whether small firms adopt ISO 9000 standards of their own free will, or are forced to do so by customers and/or government campaigns (North et al., 1998).

In the past ten years, research on quality management has increased dramatically (Filippini, 1997). However, there are still many questions about quality management left unanswered: for example, the components and definition of

quality management programmes, the impact of quality management on performance, and the relationship between TQM and other theories/methods, such as ISO 9000 (Filippini, 1997). A recent literature review (Terziovski et al., 1997) reveals a major gap in research on the relationship between TQM, ISO 9000 certificate, and performance.

Existing management literature acknowledges that there are fundamental operational differences between small and large firms. Compared with large companies, small firms have the following characteristics: small size, better internal communication, flexible, innovative, close to customers, but short of capital and skilled staff, little clout in the market, and short-term goals/objectives (Ghobadian and Galleary, 1996; Haksever, 1996; Hewitt, 1997). However, there has been little research on whether small and large firms implement TQM programmes differently (Ahire and Golhar, 1996).

Martines-Lorente, Gallego-Rodriguez and Dale (1998) argued that the implementation of TQM is affected by size. They found that there is a significant correlation between the size of organizations and the application of TQM, measured by a TQM index, indicating that large firms implemented TQM more than their small counterparts. Hewitt (1997) also argued that small firms lack interest in using the Quality Award Model in self-assessing their quality management. Burstiner (1994) pointed out the differences in organizing quality functions between small and large firms. In the small production facility, this function (quality control) is often vested in a single individual who may also have other duties. However, where the products or the manufacturing processes are more complicated, a small department may be needed to inspect products and maintain effective control.

For those small firms that implemented TQM, differences were also revealed. Ahire and Golhar (1996) conducted research comparing TQM implementation in large and small firms. They found that, apart from the fact that small firms pay more attention to customers and use Statistical Process Control (SPC) tools, there are no operational differences in TQM implementation that can be attributed to firm size.

Based on a survey of 78 large firms and 15 SMEs, Chapman and Sloan (1999) found that there appear to be similar motives for continuous improvement (CI) in both large and small firms and the content of CI implementation is also quite similar. However, significant differences were found in the usage of CI support mechanisms and problem-solving tools between large and small firms. Large firms use more training to support CI, while small firms use incentive systems and suggestion schemes as support mechanisms for CI.

Previous research on various aspects of TQM or ISO 9000 has been conducted in the SME context. However, comprehensive research covering TQM, ISO 9000 certification, business results as well as their relationships is rare. This research aims to empirically investigate the differences in TQM, ISO 9000 registration, and performance improvement as well as their relationship in SME and large companies. The variables and the relationships to be investigated are illustrated in the research framework as shown in Figure 1. The hypotheses were formulated as below.

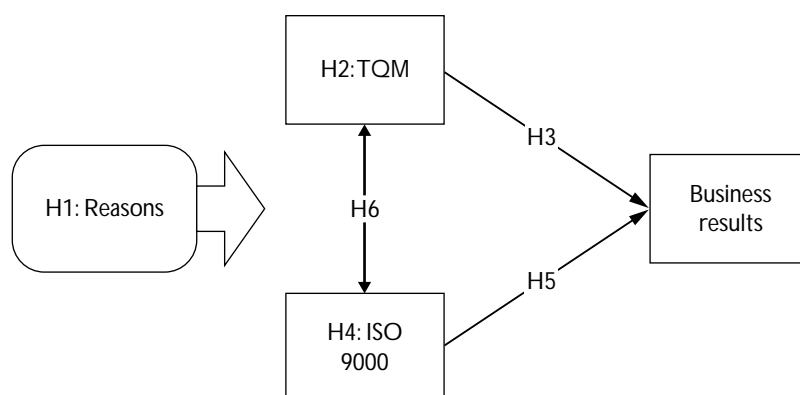


Figure 1. A Research Framework Illustrating the Hypothesis and Relevant Variables

- H1: The reasons for implementing Quality Management (QM) are different between SMEs and large companies.
- H2: TQM practices are different between SMEs and large companies.
- H3: The contribution of TQM is different between SMEs and large companies.
- H4: Small and large companies obtained ISO 9000 certificates to different extents.
- H5: ISO 9000 certificates contribute to business performance improvement differently in small and large companies.
- H6: ISO 9000 standards are incorporated with TQM differently in small and large companies.

Methodology

Survey Design and Target Sample

This study is part of an international research cooperation initiated by the University of Toledo in the USA. The same research was conducted in the USA, China, India, Mexico, Norway, and Hong Kong. The study's main aim is to provide international comparative studies of quality management practices in these countries. This article focuses on the differences between SME and large manufacturing companies. Other comparative studies will be reported separately later.

The questionnaire was designed according to the US Baldrige Quality Award Model by professors at the University of Toledo (Solis et al., 1998). It covers quality leadership, information and analysis, quality strategy, human resource development, quality assurance of process and product, customer satisfaction, social and environmental impact, and business results. In each category, there are 10–17 questions/items. All the variables in these categories are measured on a 1–5 scale, representing the strength or degree of the assessment, agreement,

perception or opinion, as the case may be, to the question item. Other information such as company size, ISO certificate, and the time length of practicing quality management is also covered by the questionnaire.

This survey was conducted in Norway with the support of the Norwegian Quality Association (NFK) and the Rogaland Research Institute (RF). Questionnaires were sent out to the 900 NFK member companies. All the contact persons are quality managers in these companies. There were 363 replies returned, a rate of about 40%. According to the research aim, 180 manufacturing companies and 85 service companies were used in this research. They are all private companies. Their sizes range from fewer than 150 employees (51%), 150–500 (31%), and more than 500 (18%).

Company size is normally measured by the number of employees. An SME is usually characterized as a company with fewer than 250 employees in the UK (DTI, 2002). However, the definition is country specific (OECD, 1997; Gudmundson, 1996). In Norway, SME refers to companies with fewer than 100 employees. The size measure in the questionnaire does not have a cut-off of 100 employees. The nearest one is 150. So in this research, 150 was used as the cut-off between SME and large companies. Based on this definition, the number of SMEs and large companies in the sample is nearly equal.

Reliability and Validity Tests

The following are the tests of reliability and construct validity (Flynn et al., 1994; Gupta et al., 1997; Nunnally, 1978; Saraph et al., 1989). The reliability was tested by Cronbach's alphas of each scales. If its loading coefficient in Cronbach alpha is less than 0.7, the factor should be discarded. The Cronbach's alphas of the scales are shown in Table 1. Except for one of the factors (F83) whose Cronbach's alpha is 0.57 and is discarded, all other scales/factors passed the reliability test.

Construct validity is established through the use of principal factor analysis. Factor analysis (Cohen, 1988; De Vaus, 1993) groups variables (i.e. single questions) into factors based on their common correlation. Those variables that are correlated with each other will be grouped together. Such a group of variables is called a factor. The grouping is based on the rotated loading coefficients. Factor analyses of the variables are shown in Table 1. In most questionnaires, scales correspond to the categories of the MBNQA model. The analysis in this research identified 15 factors, which correspond to the items in the MBNQA model. The scores of each factor are formulated by regression of the loading coefficients. The factors have means of zero and follow normal distribution, which implies that correlation and means test can be used in testing hypotheses.

Analytical Methods

The analytical methods used in this study are discriminant analysis (DA) and canonical correlation. The primary goals of DA are to find the dimension or dimensions along which groups differ and to find classification functions to predict group membership (Tabachnick and Fidell, 1989). The advantages of choosing DA over traditional analytical techniques such as analysis of variance (ANOVA) or multivariate analysis of variance (MANOVA) are twofold: first,

Table 1. Reliability and Construct Validity Tests

Code	Factors	Cronbach Alpha	Factor Analysis of Items (i.e. Questions) in Each Scale													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
F11	Leadership system	0.91	0.78	0.78	0.77	0.77	0.75	0.75	0.71	0.71	0.63	0.03	0.23	0.20	0.45	
F12	Citizenship	0.75	0.11	0.20	0.21	0.21	0.21	0.17	0.12	0.13	0.14	0.84	0.80	0.79	0.49	
F21	Availability and use	0.92	0.87	0.86	0.84	0.82	0.81	0.74	0.69	0.69	0.10	0.17	0.12	0.25	0.24	
F22	Benchmarking	0.85	0.07	0.08	0.24	0.08	0.15	0.28	0.32	0.27	0.87	0.87	0.83	0.76	0.75	
F3	Strategic management	0.90	0.81	0.79	0.78	0.77	0.74	0.74	0.73	0.72	0.66	0.44				
F41	Employee involvement	0.86	0.74	0.73	0.72	0.71	0.64	0.63	0.62	0.07	0.07	0.28	0.46	0.49		
F42	Training	0.80	0.20	−.02	0.10	0.35	0.43	0.44	0.21	0.82	0.76	0.69	0.61	0.55		
F51	Quality assurance	0.81	0.83	0.71	0.65	0.64	0.11	0.19	0.40	0.20	−.05	0.34	0.43	0.32		
F52	Design control	0.74	0.24	0.42	0.22	0.02	0.73	0.72	0.67	0.58	0.32	0.16	0.21	0.44		
F53	Process control	0.79	0.15	0.03	0.31	0.54	0.26	0.08	0.22	0.33	0.78	0.74	0.58	0.57		
F61	Supplier cooperation	0.74	0.69	0.67	0.60	0.60	0.55	0.54	0.08	0.04	0.55	0.42				
F62	Supplier selection	0.74	0.17	0.16	−.06	0.26	0.53	0.48	0.85	0.83	0.58	0.50				
F81	Customer satisfaction	0.77	0.73	0.64	0.61	0.57	0.57	−.09	0.25	0.42	0.40	0.38	−.06	0.42	0.28	
F82	Feedback	0.97	0.17	0.20	0.12	0.46	0.16	0.80	0.77	0.73	0.52	0.46	0.14	0.04	0.41	
F83	(Discarded)*	0.57	−.10	0.20	0.55	0.26	0.35	0.24	0.04	−.02	0.26	0.32	0.77	0.65	0.53	
F71	External results	0.90	0.79	0.76	0.75	0.74	0.73	0.73	0.61	0.43	0.49	0.35	0.07	0.31	0.57	0.37
F72	Internal results	0.87	0.23	0.21	0.30	0.33	0.34	0.41	0.30	0.74	0.74	0.73	0.72	0.69	0.62	0.61
E1	Employee involvement	0.88	0.81	0.80	0.75	0.74	0.72	0.71	0.67	0.64	0.62	0.61				

Note: *if its loading coefficient in Cronbach alpha is less than 0.7, the factor is discarded. Figures in bold belong to one factor.

DA can actually put cases into groups based on a discriminating function identified, i.e. classification; second, in DA there is an effort to interpret the patterns of differences among the predictors as a whole in an attempt to understand the dimensions along which groups differ. Hypotheses 1, 2, and 4 are tested using DA as prediction of group differences.

Another method used is canonical correlation. The goal of canonical correlation is to analyse the relationships between two sets of variables. It can be thought of as an extension of multiple correlation that enables researchers to investigate possible significance relationships between two sets of dependent variables, x_i and y_j . Canonical correlation analysis finds the linear compound of the set of x_i variables, which correlates maximally with a linear compound of the y_j variables. To sum up, canonical correlation is a perfect symmetric technique for assessing the degree of relationship between two sets of variables (Hotelling, 1933; Van de Geer, 1971). Hypotheses 3, 5, and 6 are tested by canonical correlation as relationships of two sets of variables are predicted.

Results and Discussions

Reasons for Implementing QM (H1)

Hypothesis 1 states that the reasons for practicing QM are different between SMEs and large companies. Respondents were asked to indicate the main reasons for implementing QM practices in their companies. Seven options were provided: (1) customer requirement; (2) need to reduce cost; (3) increased competition; (4) because of joint-venture; (5) survival of company; (6) corporate/mother company decisions; and (7) others.

This hypothesis was tested by DA. In this case, since there were only two sample groups, DA yielded only one function (dimension). This function yielded a Chi-square of 14.762 ($p = 0.039$) with 7 degrees of freedom, which was significant. Therefore, Hypothesis 1 was accepted, namely, the reasons for practicing quality management are different between large and small companies. Table 2 displays the standardized weights of the seven reasons for implementing QM in the target companies. If the weight is positive, it means large firms are stronger than SMEs in the relevant aspects. If the weight is negative, it means SMEs are

Table 2. Standardized Weights of the 7 Reasons

<i>Structure Matrix</i>	
	<i>Function 1</i>
Corporate decision	.651
Survival of company	.491
Need to reduce cost	.337
Customer's requirement	−.150
Increased competition	.079
Others	−.077
Joint venture	−.062

relatively stronger. If the weight is close to zero, it means there is no difference between SMEs and large firms.

The interpretation of DA is that large companies implement QM mainly due to corporate decision, survival of company and need to reduce cost. For small companies, the main reason is customer requirement. This result is consistent with the existing literature. For example, Ahire and Golhar (1996) reported in a study that small firms pay more attention to customer focus. Moreover, in their study of UK small firms, North et al. (1998) also stated that the main concern of UK small firms in adopting QM systems such as BS 5750 is customer requirement and pressure because '... a major customer might one day inform a business that he will no longer trade with them unless they are certificated under the standard' (North et al., 1998: 6; see also Bannock, 1991: 15).

In summarizing the reasons and motivations for implementing QM systems and measures in UK small firms, North et al. (1998) proposed that there are three distinct 'groups': 'procedural benefits', 'marketing benefits', and 'external market conditions' (pp. 9–17). 'Procedural benefits' refers to the resulting improvements to the internal operation of the firm; 'marketing benefits' refers to the adoption of a QM system as a marketing strategy; 'external market conditions' refers to the competitive customer pressures to implement QM.

When compared with the propositions put by North et al. (1998), the results of this study demonstrate some differences. For instance, the SME subjects in this study indicated that the main reason for implementing QM was customer requirement, which can be classified as the 'external market conditions' factor of the North et al. study. On the other hand, the large company subjects in this study indicated that they implement QM mainly because of corporate decision, survival of company and the need to cut cost. These reasons can be classified as the 'procedural' and 'marketing' benefits considered in the North et al. study. However, although the target sample of the North et al. study was small business, those three motivations for implementing QM may also be applied to larger companies. As demonstrated in this study, Norwegian SMEs mainly implement QM because of customer requirement or 'external market conditions', while large firms implement QM mainly because of 'procedural' and 'marketing' benefits, as argued by North et al. (1998).

The implication is that SMEs should not only regard TQM and ISO 9000 certification as the requirement by their customers. TQM and ISO 9000 standards should be used as proactive tools to improve quality management systems, improve product quality and reduce product cost. The final goal is to help a company improve its competitive capability. Different reasons may lead to different reactions and practices in implementing TQM and ISO 9000. On the other hand, large firms should not just push their SME suppliers to implement TQM and/or ISO 9000 standards but should help them to really improve quality management systems and product quality.

TQM Practices (H2)

Hypothesis 2 states that TQM practices are different between SMEs and large companies. This hypothesis was also tested by DA. The fourteen TQM factors as

shown in Table 1 were entered as predictors. One discriminant function was identified. This function yielded a Chi-square of 36.465 ($p = 0.001$) with 14 degrees of freedom, which was highly significant. Therefore, Hypothesis 2 was supported. The group centroids of SMEs on this function equal -0.842 , and large companies equal 0.714 . Table 3 displays the standardized weights of the 14 TQM factors in the target samples.

The interpretation of the DA is that large companies placed more emphasis on training, feedback, quality assurance, citizenship and supplier cooperation. SMEs placed more emphasis on leadership, employee involvement, and quality information. The result of this part of the study can also be compared to that of North et al. (1998). They stated that compared to large companies, the small firms in their study 'were much less enthusiastic about formal training'. Moreover, another difference between large and small firm practices suggested by their findings is 'in the use of customer feedback' (p. 164). They stated that small firms concentrated much more on informal training and relied much more on informal feedback, often collected unsystematically.

The result of our study is consistent with that of North et al. (1998). The large company subjects of our study indicated that in practicing TQM, they placed more emphasis on training, feedback, quality assurance, citizenship and supplier cooperation. In other words, the large firms put relatively more emphasis on the formal, structural and organizational component of TQM. On the other hand, the SMEs in our study indicated that they put more emphasis on leadership, employee involvement and availability and use of information. In other words, the SMEs concentrated more on the human, 'soft' side of TQM.

The differences discussed above may be due to the inherent distinction between SMEs and large firms. Due to their smaller size, managers in SMEs are

Table 3. Standardized Weights of the 14 TQM Factors

<i>Structure Matrix</i>	
	<i>Function 1</i>
Training	.309
Leadership	-.275
Feedback	.251
Employee involvement	-.242
Quality assurance	.240
Citizenship	.225
Availability and use	-.217
Supplier cooperation	.214
Supplier selection	-.094
Benchmarking	.037
Design control	.034
Customer satisfaction	.014
Process control	-.013
Strategic management	.008

both owners and managers. It is easier for them to communicate with employees on an operational level and easier for them to implement organization changes. The implication is that the most important aspect of TQM implementation in SMEs is the manager. If managers do not believe in and support TQM, TQM will never be implemented in the company. If managers do not have the necessary knowledge and awareness about TQM and quality management, the implementation of TQM will not be initiated.

There is also a significant difference in training. SMEs do not have the advantage of providing training because of their limited resources. The answer may be to pool their limited resources to reach the scale of training provided by consulting or large companies. Clubs, associations or other informal networks are examples of this pooling effort. Large firms may also provide resources or opportunities for their SME suppliers to join training programmes.

TQM and Business Performance (H3)

Hypothesis three states that the contribution of TQM is different between SMEs and large companies. This hypothesis was tested by canonical correlation analysis. Two sets of variables, TQM factors and Performance Improvements were entered as dependent variables in canonical correlation tests for SMEs and large firms, respectively.

For the SME subjects, one statistically significant canonical correlation function was identified with a Chi-square of 44.223, 28 degrees of freedom and a $p = 0.026$. Table 4 displays the canonical loading of the dependent variables. The canonical function indicated that the following TQM factors contributed most (in descending order):

- Employee Involvement
- Feedback
- Supplier Selection
- Strategic Management

For the large companies, one statistically significant canonical correlation function was also identified with a Chi-square of 56.251, 28 degrees of freedom and a $p = 0.001$. Table 5 displays the canonical loading of the dependent variables. The canonical function indicated that the following TQM factors contributed most (in descending order):

- Strategic Management
- Employee Involvement
- Supplier Selection
- Customer Satisfaction
- Availability
- Leadership
- Training

Comparing the results in Tables 4 and 5, it can be seen that the contribution patterns of TQM to business results/performance are different. Therefore, hypothesis 3 is supported and accepted.

Table 4. Canonical Loadings of the 14 TQM Factors for the SMEs (using 0.5 as the cutting point). Figures in bold are regarded as significantly correlated

<i>TQM Factors</i>	<i>Canonical Loading</i>
Leadership system	.344
Citizenship	.293
Availability and use	.201
Benchmarking	.431
Strategic management	.532
Employee involvement	.730
Training	.429
Quality assurance	.376
Design control	.479
Process control	.467
Supplier cooperation	.209
Supplier selection	.593
Customer satisfaction	.256
Feedback	.655

In studying the relationship between TQM practices and operational performance, Samson and Terzioviski (1999) found that leadership, personnel management and customer focus were the strongest significant predictors of operational performance. However, the detailed demographic characteristics of their subjects were not reported. They simply stated that their sample was drawn from Australian and New Zealand manufacturing sites that 'employ more than twenty people'. No classification was done to separate SMEs from large companies. Nonetheless, their results can shed some light on our study. They found that the

Table 5. Canonical Loadings of the 14 TQM Factors for the Large Firms (using 0.5 as the cutting point). Figures in bold are regarded as significantly correlated

<i>TQM Factors</i>	<i>Canonical Loading</i>
Leadership system	.564
Citizenship	.378
Availability and use	.577
Benchmarking	.428
Strategic management	.750
Employee involvement	.716
Training	.513
Quality assurance	.467
Design control	.133
Process control	.297
Supplier cooperation	.393
Supplier selection	.668
Customer satisfaction	.606
Feedback	.398

strong predictors of performance were the so-called 'soft' factors of leadership – human resources and customer focus. The more systems and analytical oriented criteria – information and analysis, strategic planning and process analysis – were not strongly and positively related to performance in the regression. Our results also demonstrated that the 'soft', 'humanistic' factors such as employee involvement, feedback, supplier selection, customer satisfaction and leadership are correlated significantly with the performance improvement. One important point to note is that, for SMEs, the dominant factors for improving organization performance are those soft and humanistic ones (employee involvement, feedback and supplier selection), while for large companies both the humanistic and organizational factors contributed to the improvement.

This result is consistent with the literature, both theoretically and empirically. Ghobadian and Gallea (1996) deductively proposed that some 'advantages' for SMEs in implementing TQM are: better leadership; higher visibility and better communication; proximity to products and customers; and simpler decision-making processes. On the other hand, North et al. (1998) concluded from their in-depth case studies of UK SMEs that small firms concentrated more on informal training and this was often 'an important element in their quality control strategies'. And this reliance on informal strategies is 'far from inferior as a method of quality control in small firms even if they might be much less effective in large enterprises'.

ISO 9000 Certification (H4)

Hypothesis 4 states that SMEs and large companies obtained ISO 9000 certificates to different extents. Respondents were asked to indicate whether their company is (1) ISO 9001 certified; (2) ISO 9002 certified; (3) ISO 9003 certified; (4) no certificates but preparing to certify in two years; (5) not interested in ISO certification. The percentages of companies in each category are illustrated in Table 6.

This hypothesis was tested by DA. The classification matrix is displayed in Table 7. One discriminant function was identified with a Chi-square of 22.863, 4 degrees of freedom and a $p \leq 0.001$ which was highly significant. The test reveals two main differences that are discussed below.

First, large companies get more ISO 9001 certification while more SMEs got ISO 9002 certification. This is because SMEs usually did not have a product design division, so an ISO 9002 certification is sufficient. In the near future, ISO 9002 and ISO 9003 will be eliminated. Only ISO 9001 (2000 version) will be kept. There is therefore no need to discuss the implication of the differences.

Second, there were more SMEs planning for the ISO 9000 certification at that time. This indicates that SMEs were lagging behind large firms in ISO 9000

Table 6. Percentages of ISO 9000 Certification

	ISO 9001	ISO 9002	ISO 9003	Plan	No-interests
SME %	32	24	0	30	13
Large %	62	13	0	13	12

Table 7. Standardized Weights of the ISO Certification Status

<i>Structure Matrix</i>	
	<i>Function 1</i>
ISO 9001 certified	.879
Preparing to certify	–.538
ISO 9002 certified	–.370
Not interested	–.033

certification. However, when adding the percentages of companies with ISO 9000 certification to those planning for ISO 9000 certification, SME and large firms are close (86% vs. 88%). As the samples of this study are all members of the Norwegian Quality Association, their quality awareness is undoubtedly high enough. Additionally, ISO 9000 certification was at its peak in the 1990s in Europe, so the percentage of ISO 9000 certification in sampled SMEs is explainable.

ISO 9000 Certification and Business Performance (H5)

Hypothesis 5 states that ISO 9000 certificates contribute to business performance improvement differently in small and large companies. This hypothesis was tested by canonical correlation. Two sets of dependent variables, ISO 9000 certification and business improvement, were entered into the calculation. For the SME samples, one marginally significant ($p = 0.053$) canonical correlation was identified. The correlation yielded a Chi-square of 15.306. The result indicated that, for the SMEs, ISO 9000 certification correlated marginally with performance improvement.

For the large company subjects, however, no significant correlation can be identified. Therefore, the hypothesis is only partially supported.

The main reason for SMEs to implement quality systems and practices is customer requirement or the 'external market conditions'. After they obtain the certification, their products are more likely to be accepted by their customers, such as other larger firms or government organizations (Hall, 1996), thus leading to an improvement in their business performance.

However, it must be noted that the correlation is only marginal ($p = 0.053$), and in the strictest sense there is no relation at all. This result can be compared to those criticisms of formalized quality systems such as ISO 9000 or BS 5750 by some commentators. For example, Bannock (1991) stated that quality systems 'may not be relevant in a small firm where quality is the personal responsibility of the owner' (p. 61). Other researchers also argued that the standard itself is 'over-complex', 'riddled with jargon' and often 'too bureaucratic' (see for example Hall, 1996; North et al., 1998).

In our large firm samples, no relation exists between ISO 9000 certification and performance improvement. This is an interesting finding. From the justification of hypothesis 3, we find that TQM practices are correlated, in different patterns,

to the performance improvement in both SMEs and large companies. ISO certifications, however, only correlated marginally (and this 'marginal' correlation can be explained in light of the 'external market conditions' and the requirements of the other large companies as discussed previously) with performance in SMEs and have no relevance at all in large companies. Thus, it can be concluded that ISO standards do play a role in helping SMEs to improve their quality and business performance, but the effect is diminished in large companies.

This result supports the propositions of ISO critics such as Van der Wiele and Brown (1997), Reedy (1994) and Stratton (1994). Undoubtedly, ISO certifications are crucial in responding to market and customer requirements, but the certification itself does not have much implication for quality and performance.

ISO 9000 Certification and TQM (H6)

Hypothesis 6 states that ISO 9000 standards are incorporated with TQM differently in small and large companies. For both SMEs and large companies, no significant correlation can be identified between the TQM factors and ISO certifications. Hypothesis 6 was, therefore, not supported.

This result is consistent with those discussed in the above section. It was also supported by other research (Sun, 1999). ISO certificates neither have any relations with TQM practices nor have any effect on the improvement of operational performances. This result is consistent with the other parts of the study, which demonstrates that the principle purpose of ISO 9000 certification is to respond to the market's and customers' demand. In other words, TQM and ISO 9000 standards were implemented separately and were not integrated or linked. This was supported by other research that covers 18 countries (Sun, 1999).

Previous research (Sun, 2000) found that ISO standards and TQM are different practices for quality management. The standard aims of ISO 9000 are to standardize certain processes and maintain the quality level while TQM aims to continuously improve quality level. They cannot replace each other. The proper combination of the two will produce more benefits.

The practical question for the latter companies is where they should head in the future. Our suggestion is that for those TQM-without-ISO 9000 companies, the future direction should be the implementation of TQM and the incorporation of TQM and ISO 9000 certificates. With the effect of ISO 9000:2000 version, the updating of ISO 9000 certificates will also be a major task for these companies.

Conclusions, Limitations and Future Research

Quality management research is one of the most frequently published areas in operations management studies. However, given its popularity, empirical studies are rare (for a review, see Cheng and Chan, 1999). However, some researchers have recently posited that empirical research will be the 'building blocks' for the next decade of quality management studies (see for example Adam and Swamidass, 1989; Ahire and Golhar, 1996; Flynn et al., 1994).

In these empirical studies, the principle focus is on large companies (for example Ahire and Golhar, 1996; Black and Porter, 1996; Flynn et al., 1994;

Saraph et al., 1989). Studies utilizing SMEs as subjects are difficult to find, let alone a study which compares and contrasts large companies and SMEs in one empirical research agenda. Our research contributes to the existing literature by empirically comparing and contrasting the reasons for, and practices and effects of quality management practices and measures in SMEs and large companies. It was found that SMEs and large companies are different in several aspects. The research results of this study are highlighted in Table 8 and summarized below; relevant limitations and directions for future research will be explored.

First, the SME subjects' main reason for implementing QM is customer requirement while large companies implement QM mainly due to corporate decision, survival of company, and the need to cut cost compared to their SME counterparts. The implication is that SMEs should not only regard TQM and ISO 9000 as being a requirement of their customers. For SMEs, TQM and ISO 9000 should be used as proactive tools to improve quality management systems, improve product quality and reduce product cost. The final goal is to help a company improve its competitive capability. For large firms, it may help just to push an SME supplier to get ISO 9000 certification. Large firms may play a role in helping SMEs improve quality management as partners rather than just as pure customers (Fasel, 2000).

Table 8. Summary of Research Results

<i>Issues</i>	<i>Large Firms</i>	<i>SMEs</i>
Reasons for practicing quality management	Corporate decision Survival of company Need to cut cost	Customers' demand
TQM practices mostly used	Training Feedback Quality assurance Citizenship Supplier cooperation	Leadership system Employee involvement Quality information
TQM practices contributing to business results	Strategic management Employee involvement Supplier selection Customer satisfaction Availability and use of quality information Leadership system Training	Employee involvement Feedback Supplier selection Strategic management
ISO certification	Mainly ISO 9001	Mainly ISO 9002, more prepare for it
ISO certification and business results	No relation	Marginally
ISO Certification and TQM practices	No relation	No relation

Second, it appears that SMEs pay more attention to leadership, human resource development and availability and use of quality information, while large companies are stronger in training, customer feedback, social responsibility and citizenship, and cooperation with suppliers. The result implies that TQM in SMEs is more people-oriented and informal while TQM programmes in large firms are more structural and process-oriented (cf. Ahire and Golhar, 1996; North et al., 1998). For both SME and large companies, the suggestion is that TQM and ISO 9000 standards should be implemented fully to take use of their full benefits.

Third, TQM contributes less in SMEs than it does in large firms. It can be concluded that TQM is more successfully implemented in large firms than SMEs. More efforts are needed to investigate how to implement TQM in SMEs successfully. This research found that those 'soft' TQM criteria such as human resources development and leadership contribute to the improvement of business performance, while others such as process assurance and quality strategy do not. This does not mean that the latter criteria are not important. As a necessary component of a TQM programme and quality award model, these criteria do have their roles to play. Perhaps although these criteria do not contribute directly to the improvement of business performance they do enhance contributing factors. This proposition needs future research and testing by methods such as path analysis of TQM.

Fourth, although SMEs implemented TQM less than large firms, the rate of adopting ISO 9000 standards is close to that of large firms. This means that SMEs focus more on ISO 9000 standards than on TQM. It may be due to the fact that large firms require their SME suppliers to get ISO 9000 certification. Again it is due to external requirement rather than internal initiation. The main task of SMEs in the future will be to go beyond ISO 9000 standards to TQM. Future research should look at the paths and approaches to help companies to incorporate ISO 9000 into TQM programmes or update ISO 9000 to the new versions.

Fifth, regarding the relationship between ISO 9000 certification and TQM implementation/business performance, no significant correlation was found. ISO standards and TQM are different practices for quality management. ISO 9000 standard aims to standardize certain processes and maintain the quality level while TQM aims to establish a quality culture and continuously improve quality level. They cannot replace each other. The proper combination of the two will produce more benefits for both SMEs and large firms. This suggests that future research should look at how to incorporate the two, either go beyond ISO 9000 or update ISO 9000 to the new version.

Finally, although part of its results are consistent with previous research (Hall, 1996; North et al., 1998, Samson and Terziovski, 1999), this research was based on the data from member companies of Norwegian Quality Association. So the results may be limited to the Norwegian context, especially those member companies. It is not yet clear whether the findings can be generalized to other countries. However, the issues revealed by the research do raise useful discussions on quality management in SMEs. Hopefully future research will provide more evidence on these issues.

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Comparaison des raisons, des pratiques et des effets de la certification ISO 9000 et de la mise en oeuvre de la TQM dans des petites et moyennes entreprises et des grandes firmes norvégiennes – Hongyi Sun et Tsz-kit Cheng

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Cet article porte sur les recherches empiriques qui examinent les raisons, les pratiques et les effets de la certification ISO 9000 et de la mise en oeuvre de la gestion totale de la qualité (Total Quality Management – TQM) dans des petites et moyennes entreprises (PME) et des grandes sociétés de fabrication. Les recherches sont basées sur une enquête portant sur 180 sociétés de fabrication norvégiennes. Les principales conclusions sont les suivantes: (1) les PME mettent en oeuvre les normes ISO 9000 et la TQM principalement à cause de la demande des marchés et des clients ou de la pression externe plutôt que de l'initiation interne; (2) en pratiquant la TQM, les PME se concentrent sur des approches informelles axées sur les gens; les grandes firmes sont relativement plus structurées, organisées et axées sur les processus; (3) des facettes différentes de la TQM contribuent différemment dans les PME et les grandes firmes; (4) il n'existe pas de rapports significatifs entre les pratiques actuelles de la certification ISO 9000 et de la TQM/l'amélioration de la performance commerciale. La conclusion est qu'il y a des différences significatives entre les PME et les grandes firmes au niveau de la mise en oeuvre de la certification ISO 9000 et de la TQM. Ces différences déclenchent des discussions sur les implications pratiques pour les responsables dans les PME et les grandes firmes. Pour terminer, la limitation et les recherches futures ont été explorées.

Mots clés: étude comparative, certification ISO 9000, gestion de la qualité, PME, TQM

Razones, prácticas y efectos comparativos de la certificación ISO 9000 y la implementación de TQM en las PYME y grandes empresas noruegas – Hongyi Sun y Tsz-kit Cheng

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Este artículo documenta la investigación empírica que examina las razones, prácticas y efectos de la certificación ISO 9000 y la implementación de la gestión de calidad total (TQM, siglas de *Total Quality Management*) en las pequeñas y medianas empresas (PYME) y grandes industrias manufactureras. La investigación se basa en una encuesta de 180 industrias manufactureras noruegas. Los resultados principales son: (1) La implementación de las normas ISO 9000 y la TQM por las PYME se debe más bien a las demandas del mercado y de los clientes o a una presión externa, que a una iniciativa interna; (2) en la ejecución de la TQM, las PYME adoptan un enfoque informal, orientado hacia la gente; las empresas grandes son relativamente más estructuradas, organizadas y orientadas hacia los procesos; (3) las distintas facetas de la TQM contribuyen de manera diferente a las PYME y a las grandes empresas; (4) no existe una relación significativa entre la certificación ISO 9000 actual y las prácticas/mejoras de la TQM en cuanto a la actuación empresarial. Se llega a la conclusión de que hay algunas diferencias importantes entre la implementación de la certificación ISO 9000 y la TQM por las PYME y por las grandes empresas. Estas diferencias provocan polémicas sobre las consecuencias prácticas para los directores de las PYME y de las grandes empresas. Por último, se examinan las limitaciones y futuras investigaciones.

Palabras claves: estudio comparativo, certificación ISO 9000, gestión de la calidad, PYME, TQM.

Vergleich von Gründen, Vorgehensweisen und Auswirkungen mit Bezug auf ISO-9000-Zertifizierung und TQM-Einführung (Einführung des umfassenden Qualitätsmanagement) in kleinen, mittleren und großen Unternehmen Norwegens – Hongyi Sun und Tsz-kit Cheng

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Dieser Artikel hält die empirische Forschungsarbeit fest, die sich mit den Gründen, Vorgehensweisen und Auswirkungen bezüglich der ISO-9000-Zertifizierung und der Einführung des umfassenden Qualitätsmanagement (TQM) in kleinen, mittleren und großen Produktionsunternehmen befasst. Die Forschungsarbeit beruht auf einer Umfrage bei 180 norwegischen Produktionsunternehmen. Die Hauptergebnisse sind: (1) Die kleinen und mittleren Unternehmen führen die Grundsätze nach ISO 9000 und TQM hauptsächlich ein, weil Markt und Kunden oder äußerer Druck es verlangen und nicht aufgrund eines inneren Anstoßes; (2) beim Einsatz von TQM legen die kleinen und mittleren Betriebe den Schwerpunkt auf informelle, personenbezogene Vorgehensweisen, während Großunternehmen im Verhältnis strukturierter, organisationsbezogener und prozessorientierter Verfahren; (3) verschiedene TQM-Elemente leisten in kleinen und mittleren Unternehmen andere Beiträge als in Großunternehmen; (4) zwischen der aktuellen ISO-9000-Zertifizierung und TQM-Einsätzen/Verbesserung der geschäftlichen Leistung besteht keine signifikante Beziehung. Die Schlussfolgerung ist, dass es zwischen kleinen und mittleren Unternehmen einerseits und Großunternehmen andererseits einige signifikante Unterschiede bei der Umsetzung von ISO-9000-Zertifizierung und TQM gibt. Diese Unterschiede lösen Diskussionen über praktische Auswirkungen für Manager in kleinen und mittleren Unternehmen auf der einen und großen Unternehmen auf der anderen Seite aus. Abschließend wurden eine Begrenzung und künftige Arbeiten untersucht.

Schlagwörter: Vergleichsstudie, ISO-9000-Zertifizierung, Qualitätsmanagement, kleine und mittlere Unternehmen, TQM